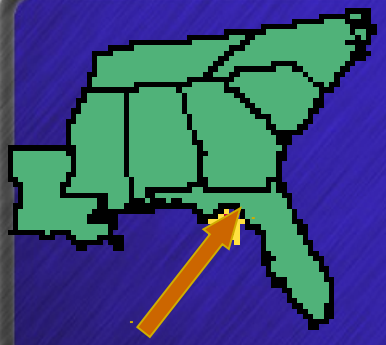
# HYBRID Propellant for Small, Medium and Large Caliber Applications

## St. Marks Powder

# Agenda

- Plant Overview
- HYBRID Propellant Technology
- Small Caliber Applications
- Medium Caliber Applications
- Large Caliber Applications
- Summary



# St. Marks Powder

## *Producing Propellant Since 1970*

- **1974 acres, 137 buildings, 6.5 miles of roads**

- **Propellant production**

  **> 150 products**

  **Product mix 50% Military & 50% Commercial**

  **Largest producer of military and commercial small arms propellant in the U.S.**

# HYBRID Gun Propellant

## New From St. Marks Powder

**PERFORATED • DETERRED**

**Ultimate ballistic efficiency achieved by combining perforated geometry with burn rate modifiers (deterrents)**

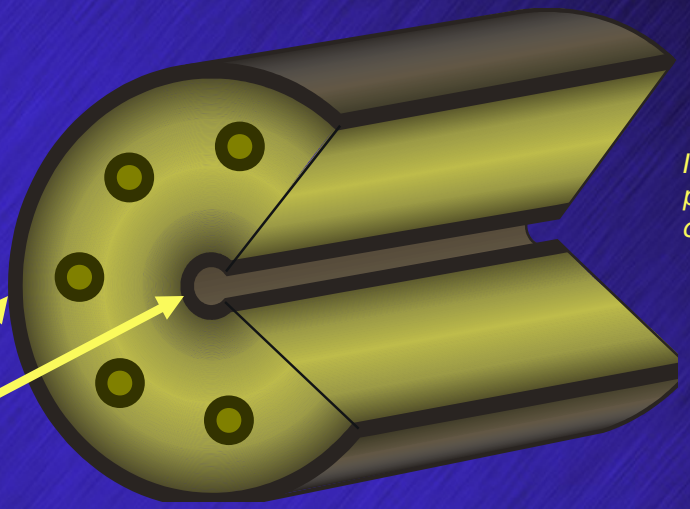


*Illustration of a propellant grain cross section*

**Deterrent Layer - applied to tailor the burn rate for specific applications to optimize ballistic efficiency**

**HIGH PERFORMANCE** - Optimum burn progressivity
High loading densities

**COOL BURNING** - Low erosion & low flash

**ECONOMICAL** - Modified conventional process



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# HYBRID Propellant is Manufactured in Single, Seven, and Nineteen Perf Geometries for Application Flexibility

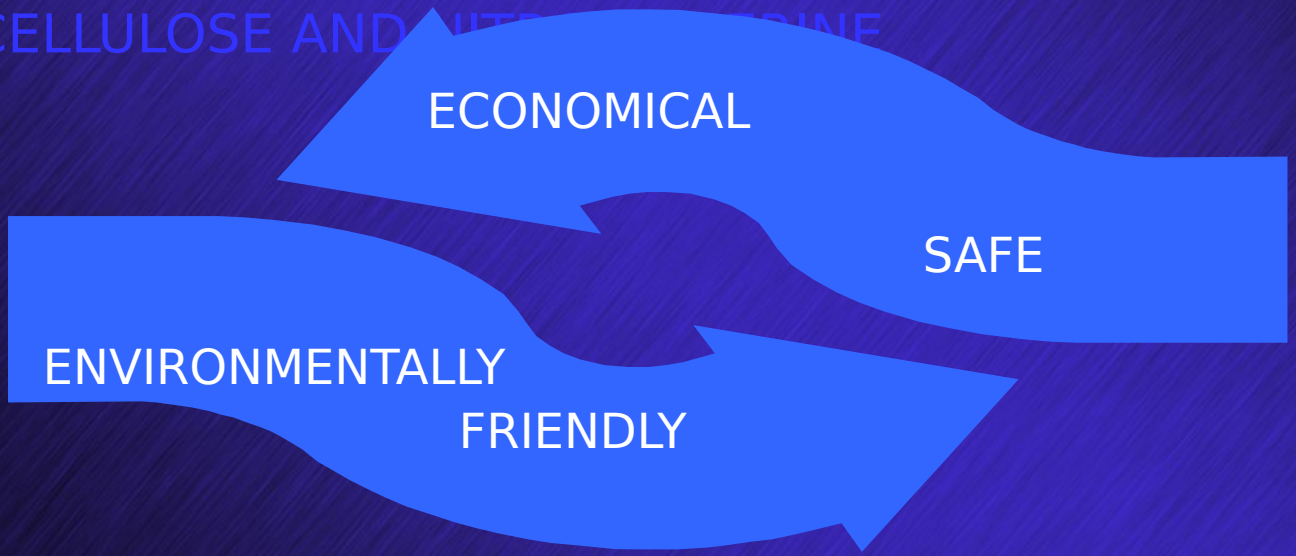
- Single Perf for reduced barrel wear (cooler burning)

- Seven Perf for higher energy performance (less deterrent)

- Nineteen Perf for greatest bed permeability

# Manufacturing Process

**HYBRID PROPELLANTS ARE PROCESSED UNDERWATER IN A SAFE, ECONOMICAL AND ENVIRONMENTALLY FRIENDLY MANNER** - THEY UTILIZE CONVENTIONAL PROPELLANT INGREDIENTS: NITROCELLULOSE AND [illegible]



# HYBRID Propellant for Small Caliber Applications

- Due to its progressive geometry and chemistry, HYBRID propellants are ideal for small caliber rifle applications
  - Demonstrated 10% charge weight reduction in centerfire rifle applications with excellent temperature sensitivity
  - Great for long range sniper applications

# HYBRID Propellant for Medium Caliber Applications

# St. Marks Powder HYBRID Propellant Super 40MM Air Burst Test Summary:

Target Velocity = 1050 mps at P+3SD< 480 MPa

| Temp | Velocity | Pressure | Action Time |
|---|---|---|---|
| +70º F | 1049 mps | 399 MPa | 4.13 ms |
| -65º F | 1046 mps | 402 MPa | 4.08 ms |

Achieved the same velocity as the 30mm GAU-8/A (same envelope) with a 675g 40m projectile compared to the standard 367g 30mm projectile.



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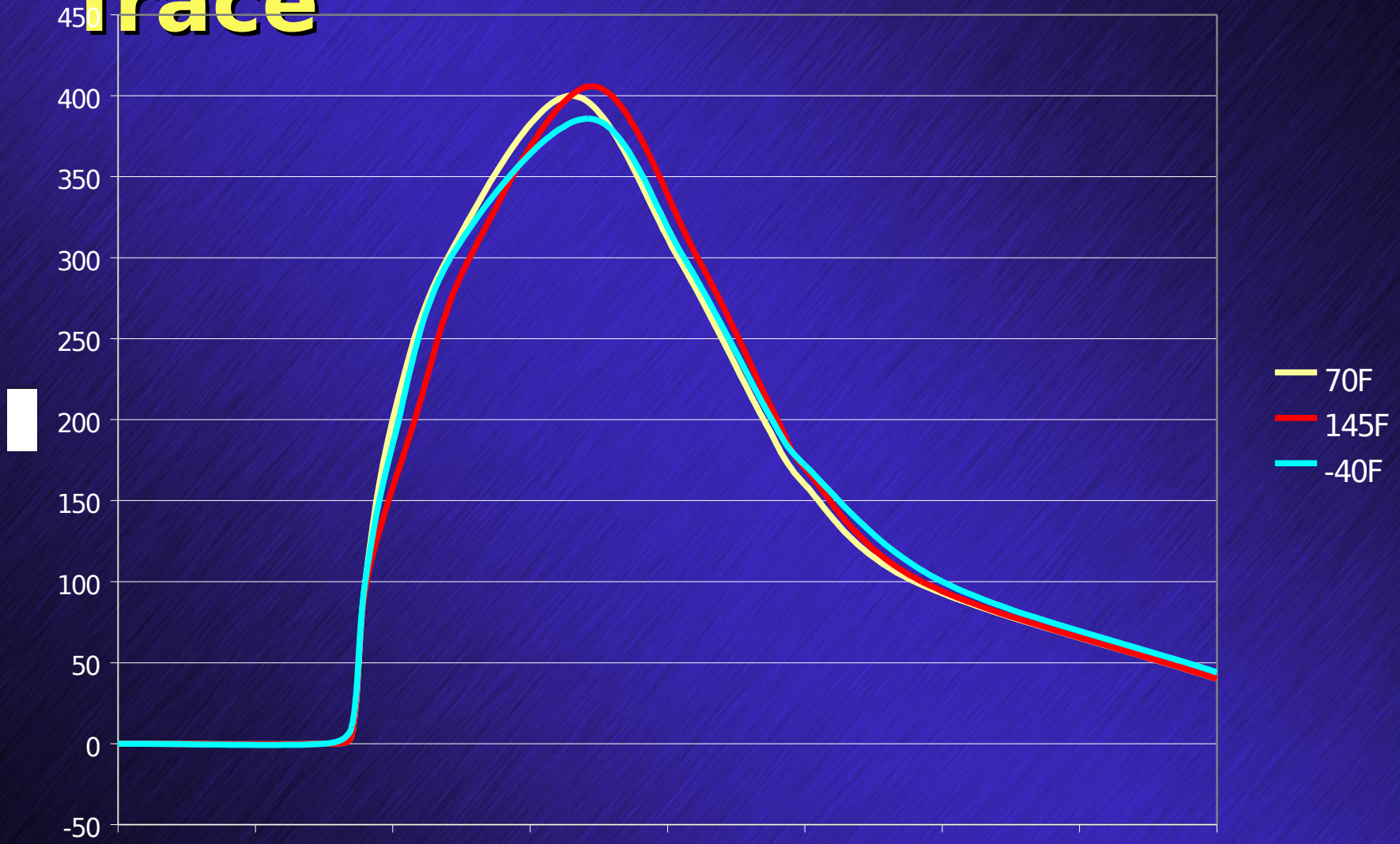
# 40mm AB Pressure-Time Trace



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# Increased Muzzle Energy through Compaction

- HYBRID propellants are plastic in nature and compressible. Through the utilization of High Density Propelling Charge Technology (HDPC) the charge weight was increased by 30% over loose loaded propellant.

- Benefits of compacted propellant versus optimal loose HYBRID propellant
  - 22% increase in muzzle energy
  - Lower Flame Temperature (50°K)
  - Improved Temperature Performance

# HYBRID Propellants for Large Caliber Applications

- HYBRID Propellants can be produced with flame temperatures ranging from 2,000°K (Impetus = 800 j/g) to 3,500°K (Impetus = 1150 j/g) for a variety of applications
  - Multi-Perf, high energy formulations are ideal for advanced KE, direct fire ammunition
  - Low Flame Temperature HYBRID propellants provide exceptional ballistic performance and extended barrel life for high cyclic rate Army and Navy indirect fire applications

# Large Caliber Test Results

**105mm M900 HYBRID Demonstration April ’02 @YPG**

**Demonstrated Velocity Increase**

**7 Perf HYBRID + 60.0 Meters/Second**

**3 Round Std. Dev. = 1.6 M/S**

**Baseline Propellant 3 Round Std. Dev. =**

St. Marks Powder

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# HYBRID Propellant for FCS Applications

**HYBRID Propellant**

*The New Technology Provides:*

- *The highest possible muzzle velocity for Maximum Range*
- *A Lower Flame Temperature for Extended Barrel Life and No Muzzle Flash in most applications*
- *Environmentally friendly domestically produced raw materials*
- *Low Cost Conventional Ingredients*
- *Applicable to the full spectrum of envisioned Precision Guided Munitions (PGMs) and related propulsion systems.*